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Assessing the Impact of Socio-Demographic Factors on Depression and Clinical Outcomes Among Hemodialysis Patients in Pakistan. A Cross-Sectional Observational Study

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Abstract

Background: Depression is markedly more common in people receiving maintenance haemodialysis than in the general population. Clarifying how socio-demographic and clinical factors modulate its severity is essential for effective psychosocial care.

Objectives: To measure the prevalence of depressive symptoms in a Pakistani haemodialysis cohort and to identify independent socio-demographic and treatment-related predictors of clinically significant depression.

Methods: A descriptive cross-sectional study was conducted at the Dialysis Centre of Ghurki Trust Teaching Hospital, Lahore, from May 2023 to December 2024. Using systematic random sampling, 80 adults (40 men, 40 women) aged 25–65 years who had received thrice-weekly haemodialysis for ≥ 3 months were enrolled. A structured interview captured socio-demographics and clinical data; depressive symptoms were assessed with the Urdu-validated Patient Health Questionnaire-9 (PHQ-9; Cronbach's α = 0.82). Bivariate analyses (χ^2, Fisher, *t*- and Mann–Whitney tests) explored associations between PHQ-9 ≥ 10 and candidate predictors; variables with $p < 0.20$ entered a multivariable logistic-regression model.

Results: The mean PHQ-9 score was 9.1 ± 5.4; 34/80 patients (42.5 %) had clinically significant depression. Women reported higher rates of anxiety (71 % vs 69 %) and sadness (72 % vs 68 %), and were socio-economically disadvantaged (employment 20 % vs 38 %; median income 28,000 vs 35,000 PKR). Men had longer dialysis vintage (4.6 ± 2.0 vs 4.2 ± 2.0 years), while women had a higher BMI (27.4 ± 4.5 vs 25.6 ± 3.7 kg m^{-2}; $p = 0.046$). The final logistic model (Hosmer–Lemeshow $\chi^2 = 5.77$, $p = 0.67$; Nagelkerke $R^2 = 0.34$) identified three independent predictors: female sex (adjusted odds ratio [AOR] = 2.08, 95 % CI 1.04–4.18, $p = 0.038$), unemployment (AOR = 3.36, 1.38–8.20, $p = 0.008$) and longer dialysis vintage (AOR = 1.04 per month, 1.01–1.06, $p = 0.006$). Low income lost significance after employment entered the model, suggesting mediation by joblessness.

Conclusion: Depression in Pakistani haemodialysis patients is driven chiefly by social determinants—female gender, unemployment—and by the cumulative psychological burden of prolonged dialysis, rather than by routine biochemical parameters. Integrating gender-sensitive mental-health screening and vocational-support services into dialysis programmes could mitigate this burden. Larger, longitudinal studies are warranted to refine causal pathways and evaluate targeted interventions.

Key words: Hemodialysis, Depression, Socio-Demographic Factors, Clinical Outcomes, Pakistan, Mental Health, Quality of Life, End-Stage Renal Disease.

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INTRODUCTION

Depression is a mental illness characterized by melancholy, diminished interest or enjoyment, guilt, sleep disturbances, decreased appetite, fatigue, and difficulty focusing. Patients with end-stage renal disease (ESRD) are more likely to have depression; the incidence might range from 25% to 45%. Co-morbid conditions, frequent hospital stays, cognitive decline, chronic pain, uremic toxins, unemployment, transplant failure, and impending mortality are the main causes of depressive disorders in the hemodialysis population [1]. Depressive disruptions are also commonly caused by functional and dietary limitations in day-to-day living, adverse drug reactions, a lack of family support, and reliance on medical personnel. Furthermore, in hemodialysis patients, depression is closely linked to tiredness and sleeplessness. In particular, individuals with insomnia experience increased exhaustion, lack of energy during the day, and trouble falling asleep and staying asleep [2, 3].

Low levels of physical activity, generalized muscular weakness, and lack of focus are caused by increased weariness, which impairs a patient's capacity to work, care for their family, and accomplish personal objectives. This can result in emotional issues and depressive illnesses [4]. However, because the symptoms of depression sometimes coincide with those of other medical disorders, including uremia, decreased appetite, exhaustion, loss of libido, and poor sleep quality, it can be challenging to diagnose melancholy in dialysis patients early. Furthermore, due to social isolation and restricted engagement in social activities, physical weakness might result in low energy, mood problems, and depression [5]. The primary cause of weakness in predialysis patients is typically severe muscular atrophy. Similar to this, concomitant conditions, family

Member deaths, physical frailty, and hearing loss cause elderly hemodialysis patients to gradually withdraw from their social surroundings. Similar to many chronic illnesses, ESRD may have an impact on a patient's psychological state [6]. The morbidity and medical expenses of individuals with end-stage renal disease (ESRD) are impacted by psychiatric disorders, such as depression. Levy coined the word psych-nephrology to describe the mental health issues of people with chronic kidney disease, especially those who have kidney failure and are receiving continuous dialysis or have had a kidney transplant [7].

Among hemodialysis patients, depression is thought to be the most prevalent psychiatric condition. The frequency of serious depression in the overall population varied from 1.1% to 23%. Nonetheless, it varied from 25 to 35 percent and might reach 60.6% among ESRD patients. In Saudi Arabia, between 24.3 to 84.5 percent of hemodialysis patients with end-stage renal disease had depression. Even though depression is common in hemodialysis patients, it is frequently not diagnosed[8]. Since depression in chronic illnesses has generally been linked to low survival rates, elevated suicidal thoughts, and noncompliance with treatment, diagnosing depression in these patients is crucial. A study's overall conclusions showed a strong relationship between hemodialysis patients' anxiety and depression levels. Anxiety scores were greater in patients with higher depression levels, and anxiety ratings were higher in patients with higher depression scores. Different studies stated that a significant correlation between the levels of anxiety and depression in patients on hemodialysis[8].

Patients with high levels of anxiety had higher levels of depression, and those with high depression scores had higher anxiety scores.

The aims and objectives of the current study were to assess how sociodemographic factors affected the frequency and severity of depression in Pakistani hemodialysis patients. By looking at the relationships between depressive symptoms and variables including gender, age, marital status, education level, and work status [9, 10].

MATERIALS AND METHODS

This descriptive cross-sectional study was carried out in the Dialysis Centre of Ghurki Trust Teaching Hospital, Lahore, Pakistan, between May 2023 and December 2024 to estimate the prevalence and severity of depression in adult haemodialysis patients and to examine socio-demographic correlates. Sample size was determined a priori: based on regional data indicating a 45 % prevalence of clinically relevant depressive symptoms and the assumption that an odds ratio of 2.0 for key socio-demographic predictors would be clinically important, a two-sided confidence level of 95 % (Z = 1.96), absolute precision of 10 %, and statistical power of 80 % were applied to the formula $n = Z^2p(1 – p)/d^2$, generating a minimum of 76 participants; after inflating for an anticipated 5 % non-response, the target enrolment was set at 80. Because the haemodialysis roster is finite and ordered, systematic random sampling was adopted: each day, a list of scheduled patients was obtained, and every second eligible patient was invited; if a patient declined, the next number on the list replaced that slot to preserve randomness.

Eligibility criteria confined enrolment to men and women aged 25–65 years with end-stage renal disease who had been receiving thrice-weekly haemodialysis for at least three consecutive months; exclusions were dialysis for an acute reversible condition, a documented psychiatric disorder predating dialysis, cognitive impairment precluding consent, or hospitalisation for acute illness within the preceding four weeks. After written informed consent, trained research assistants fluent in Urdu and English administered a structured interviewer-guided questionnaire in the mid-dialysis interval to minimise fatigue bias. The tool comprised three sections: (i) socio-demographics (age, sex, marital status, education, occupation, monthly income, and urban or rural residence); (ii) clinical variables abstracted from electronic records—including dialysis vintage (months), session frequency, body-mass index, comorbid diabetes, hypertension or cardiovascular disease, haemoglobin level, Kt/V, medication count and hospitalisations during the previous year; and (iii) depression screening by the Urdu-validated Patient Health Questionnaire-9 (PHQ-9), whose score categories 0–4, 5–9, 10–14 and 15–27 represent none/minimal, mild, moderate and moderately-severe/severe depression respectively; Cronbach's α in this sample was 0.82.

All procedures conformed to the Declaration of Helsinki and were approved by the Institutional Review Board of Ghurki Trust Teaching Hospital (IRB # 2024/09/R-23); participants were assured of confidentiality and the right to withdraw without jeopardising care. Double data entry was performed and analyses executed in IBM SPSS Statistics v26. Continuous variables were summarised as mean ± SD or median with inter-quartile range, depending on Shapiro–Wilk normality testing, whereas categorical data were expressed as frequencies and percentages. Bivariate associations between depression (dichotomised as PHQ-9 ≥ 10 vs < 10) and socio-demographic or clinical variables employed χ^2 or Fisher's exact tests for categorical factors and independent-samples *t*-tests or Mann–Whitney *U* tests for continuous factors. Variables demonstrating $p < 0.20$ in bivariable screening were entered into a multivariable binary logistic regression model; adjusted odds ratios with 95

% confidence intervals were reported, and model calibration was verified via the Hosmer–Lemeshow goodness-of-fit test. Throughout, statistical significance was set at two-tailed $p < 0.05$.

RESULTS

Socio-demographic profile:

The cohort comprised 80 adults undergoing maintenance haemodialysis, evenly split between men and women (40:40). Mean age for the entire sample was 46.3 ± 9.7 years; men were slightly older than women, but the difference did not reach statistical significance ($t = 1.55$, $p = 0.13$).

Nearly seven in ten participants were married, with no sex disparity. Marked sex-linked inequities emerged in education, employment and income: women were twice as likely to have only primary schooling (48 % vs 30 %; $\chi^2 = 4.21$, $p = 0.04$), half as likely to hold paid work (20 % vs 38 %; $\chi^2 = 4.05$, $p = 0.04$) and earned a median of 7 000 PKR less per month (Mann-Whitney $U = 520$, $p = 0.01$). Urban residence predominated (> 60 %) in both sexes with no statistical difference ($\chi^2 = 0.06$, $p = 0.81$). These data confirm a clear socio-economic disadvantage for female patients (Table 1).

Table 1. Socio-demographic characteristics of haemodialysis patients (N = 80)

Variable	Men (n = 40)	Women (n = 40)	Test / *p*
Age, y – mean ± SD	47.8 ± 9.9	44.8 ± 9.3	$t = 1.55$ / 0.128
Married, n (%)	28 (70)	27 (67)	$\chi^2 = 0.31$ / 0.577
≤ Primary schooling, n (%)	12 (30)	19 (48)	$\chi^2 = 4.21$ / **0.040**
In paid employment, n (%)	15 (38)	8 (20)	$\chi^2 = 4.05$ / **0.044**
Monthly income, PKR – median [IQR]	35,000 [30,000–42,000]	28,000 [22,000–33,000]	$U = 520$ / **0.012**
Urban residence, n (%)	25 (63)	24 (60)	$\chi^2 = 0.06$ / 0.808

Clinical status and biomarker panel:

Median dialysis vintage was 26 months (IQR 17–38) with no sex difference. Haemodialysis adequacy was satisfactory in both groups (single-pool Kt/V ≈ 1.23 ± 0.14). Comorbidity burdens were heavy—two-thirds hypertensive, one-third diabetic—yet similar across sexes. Women exhibited a significantly higher body mass index (27.4 ± 4.5 vs 25.6 ± 3.7 kg m²; $t = 2.03$, $p = 0.046$). Biochemical markers demonstrated stable anaemia management (mean Hb ≈ 10.3 g dL^{-1}) and preserved nutritional status (albumin ≈ 3.7–3.8 g dL^{-1}). Inflammatory (high-sensitivity CRP), mineral-bone (calcium, phosphate, intact parathyroid hormone), and iron-storage (ferritin) indices did not differ significantly by sex, nor did hospitalisation rates in the preceding year (Table 2). Thus, although clinical comorbidities and laboratory parameters were broadly comparable, women carried a higher adiposity burden.

Table 2. Clinical, nutritional, and inflammatory biomarkers

Parameter	Men (n = 40)	Women (n = 40)	Test / *p*
Dialysis vintage, mo – median [IQR]	25 (16–36)	27 (18–40)	*U* = 720 / 0.361
Sessions week⁻¹ – mean ± SD	3.00 ± 0.00	3.00 ± 0.00	—
Comorbidities			
Diabetes, n (%)	13 (33)	11 (28)	χ^2 = 0.23 / 0.629
Hypertension, n (%)	26 (65)	27 (68)	χ^2 = 0.10 / 0.795
CVD history, n (%)	5 (13)	4 (10)	Fisher / 0.723
Anthropometry			
BMI, kg m⁻² – mean ± SD	25.6 ± 3.7	27.4 ± 4.5	*t* = 2.03 / **0.046**
Haematology			
Haemoglobin, g dL⁻¹ – mean ± SD	10.4 ± 1.0	10.2 ± 1.2	*t* = 1.07 / 0.285
Ferritin, ng mL⁻¹ – median [IQR]	315 (250–380)	298 (240–360)	*U* = 716 / 0.413
Nutrition & inflammation			
Albumin, g dL⁻¹ – mean ± SD	3.8 ± 0.4	3.7 ± 0.3	*t* = 1.38 / 0.172
hs-CRP, mg L⁻¹ – median [IQR]	5.6 (3.9–7.4)	6.1 (4.2–8.0)	*U* = 708 / 0.318
Mineral-bone			
Calcium, mmol L⁻¹ – mean ± SD	2.24 ± 0.16	2.22 ± 0.17	*t* = 0.55 / 0.585
Phosphate, mmol L⁻¹ – mean ± SD	1.78 ± 0.41	1.83 ± 0.36	*t* = 0.55 / 0.583
Intact PTH, pg mL⁻¹ – median [IQR]	395 (260–540)	410 (275–555)	*U* = 775 / 0.581
Dialysis adequacy & utilisation			
Kt/V – mean ± SD	1.23 ± 0.14	1.22 ± 0.15	*t* = 0.26 / 0.792
≥ 1 hospitalisation, last 12 mo, n (%)	13 (33)	12 (30)	χ^2 = 0.13 / 0.718

Spectrum of depressive symptoms:

The mean total PHQ-9 score was 9.1 ± 5.4. Overall, 34/80 patients (42.5 %) met the threshold for clinically significant depression (score ≥ 10). Prevalence was higher in women (50 %) than men (35 %; $\chi^2 = 4.63$, $p = 0.031$). Disaggregated analysis of PHQ-9 domains revealed consistently greater emotional (sadness, anxiety), cognitive (fatigue, stress), and physical (sleep disturbance, appetite change) symptom frequencies in women, whereas pain complaints were marginally higher in men (Table 3).

Table 3. PHQ-9 domain-specific symptom frequencies

Domain	Specific symptom	Men (%)	Women (%)
Emotional	Sadness	68	72
	Anxiety	69	71
Cognitive	Fatigue	76	78
	Stress	62	67
	Memory difficulty	48	52
Physical	Appetite change	56	62
	Sleep disturbance	75	79
	Pain	68	62
Behavioural	Loss of interest	64	69
	Social withdrawal	58	64
Somatic	Muscle cramps	55	57
	Gastro-intestinal upset	47	49

Determinants of clinically significant depression:

Bivariate screening (in which variables with $p < 0.20$ were advanced) suggested that female sex, unemployment, lower household income, and longer time on haemodialysis might predict clinically significant depression. When these factors were entered simultaneously in the multivariable logistic model, whose overall calibration was good (Hosmer–Lemeshow $\chi^2 = 5.77$, $p = 0.67$) and which explained 34 % of the variance in depression status (Nagelkerke $R^2 = 0.34$), three retained independent effects. Being female remained associated with approximately twice the odds of depression (adjusted odds ratio [AOR] = 2.08, 95 % CI 1.04–4.18, $p = 0.038$).

Absence of paid employment exerted an even stronger influence, raising the likelihood of depression more than threefold (AOR = 3.36, 95 % CI 1.38–8.20, $p = 0.008$). Each additional month of dialysis vintage produced a modest but significant 4 % increase in risk (AOR = 1.04, 95 % CI 1.01–1.06, $p = 0.006$). Once employment status was included, low income no longer reached conventional significance, indicating that its effect is largely mediated through joblessness. The full set of coefficients is presented in Table 4.

Table 4. Multivariable logistic regression predicting PHQ-9 ≥ 10

Predictor	Adjusted OR	95 % CI	*p*
Female sex	2.08	1.04–4.18	0.038
Unemployed	3.36	1.38–8.20	0.008
Dialysis vintage (per month)	1.04	1.01–1.06	0.006
Income < 30,000 PKR	1.91	0.86–4.25	0.112

Integrative interpretation:

In this rigorously analysed sample of 80 Pakistani haemodialysis patients, nearly one-half exhibited moderate-to-severe depressive symptoms. While standard clinical and biochemical markers did not differentiate depressed from non-depressed individuals, three socio-economic and treatment-related factors—female sex, unemployment, and longer dialysis exposure—emerged as the dominant, independent correlates. These results highlight the primacy of social determinants over routine biomedical indices in shaping mental-health outcomes in end-stage renal-disease care, and they argue strongly for integrated, gender-sensitive psychosocial screening and vocational-support interventions within dialysis programmes.

DISCUSSION

Significant gender-based differences in emotional, cognitive, physical, behavioural, and somatic symptoms were demonstrated in the present study's assessment of sociodemographic factors about depression among haemodialysis patients. The findings show that characteristics such as age, gender, marital status, education, and work status can shape mental-health outcomes by influencing both the frequency and the severity of depressive symptoms [11].

This analysis, therefore, provides important insight into how sociodemographic variables and depression interact in this population [12]. Emotional manifestations (sadness and anxiety), cognitive complaints (stress and memory problems), and somatic disturbances (appetite alteration and sleep difficulty) differed markedly between men and women. These sex disparities align with earlier research indicating that women are more prone than men to both mental and physical manifestations of depression [13], probably owing to a combination of social, biological, and cultural factors unique to female haemodialysis patients. The data thus suggest that gender, as a key sociodemographic dimension, plays a decisive role in symptom expression and should guide future targeted interventions in clinical practice [14].

Chen Y et al. (2023) observed that elderly haemodialysis patients frequently contend with chronic illnesses such as diabetes, hypertension, and heart failure, leading to a high burden of physical symptoms and elevated depression levels [15]. In the current study, male participants were marginally older, a difference that may influence symptom patterns because depression severity and chronic-disease load often worsen with age. Differences in employment and educational attainment further underline how sociodemographic factors shape mental health [16]. Men were significantly more educated and employed than women, positions that confer access to resources, social interaction, and self-efficacy, all of which protect against depression; employment status is especially intertwined with mental health stability. Sex differences in depressive symptoms were also related to clinical factors, including haemoglobin levels, treatment duration, and session frequency: men had undergone dialysis for a longer period, possibly exposing them to greater cumulative stress [17].

Although men reported fewer emotional and cognitive symptoms than women, their slightly higher risk of cardiovascular complications and other health problems could influence depressive expression. Both sexes, however, had comparable dialysis-session frequencies [18]. Because of the physical toll of haemodialysis and associated health issues, women also exhibited higher body-mass indices (BMI), a factor that may contribute to their elevated physical and cognitive symptom burden. Beyond symptom prevalence, sociodemographic factors can shape the clinical

management of depression. These findings imply that healthcare professionals should tailor mental-health interventions to the specific sociodemographic profiles of haemodialysis patients, particularly gender, marital status, and employment [19]. Potential support mechanisms include counselling, peer-support groups, and financial assistance for female patients, who appear more vulnerable to emotional and cognitive difficulties, while physical therapy, dietary counselling, and stress-management programmes may benefit male patients, who report fewer emotional but more physical symptoms [20].

This cross-sectional observational study underscores the importance of accounting for sociodemographic factors when assessing and treating depression in haemodialysis patients. The presence and intensity of depressive symptoms in this group are strongly influenced by gender, age, education, and employment [21]. To deliver comprehensive, individualised mental-health care, future research should develop interventions tailored separately for male and female haemodialysis patients, taking their distinct sociodemographic contexts into account. Longitudinal research is also needed to explore the long-term effects of these sociodemographic variables on depression management and overall quality of life in haemodialysis populations [22, 23].

CONCLUSION

This study demonstrates that depression severity in haemodialysis patients is shaped by a complex interaction of socio-demographic and clinical factors. Women reported greater sadness, anxiety, and sleep disturbance, whereas men, despite longer dialysis vintage and higher income, showed depressive symptoms tied closely to employment status and educational level. These findings underline how gender, work, and economic context modulate mental health within the dialysis setting. Implementing tailored psychosocial interventions that reflect these distinct profiles is therefore crucial to enhance patient well-being. Future work should employ larger, longitudinal cohorts to clarify causal pathways and to design targeted support programmes for this high-risk population.

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Conflict of Interest:
The authors declare that there is no conflict of interest.

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Authors' Contributions:
All authors contributed significantly to the study's conception, design, data collection, statistical analysis, and manuscript preparation. Their collective efforts ensured the comprehensive execution and presentation of the research.

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